

Davis Joint Unified School District Food Waste Diversion Project
FINAL REPORT

Contract #IWM-C9061E
Submitted by: Cynthia Havstad, Project Manager
and Lynn Wheeler, Assistant Project Manager
July 6, 2001

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Executive Summary

The Davis Joint Unified School District piloted food waste composting systems at Birch Lane, Cesar Chavez and Pioneer Elementary schools during the 2000-2001 school year. The goal of the Food Waste Diversion Project was to develop and test site-specific systems to reduce the lunch waste stream and in particular to reduce the food waste components of the lunch waste while engaging students in the ongoing practice of composting and recycling. Our goals were to integrate the composting program into our school garden program, as part of a larger Farm to School vision, train teachers to include composting in the curricula and thus provide students with hands-on learning activities, model the practice of reduce, reuse, recycle and rot, educate the community and create a sustainable program.

The DJUSD is uniquely poised to model how a medium-sized school district conceptualizes and implements a lunch food waste diversion program in a suburban county. The food waste diversion project was created by the Davis Farm to School Connection, a coalition of district staff, parents and community members with a vision to educate and nourish students through a farm and garden-based experience. The coalition, a project of the Davis Educational Foundation, has raised funds to link school gardens to the opportunities for students to eat from locally supplied salad bars, to compost lunch food waste, to visit local farms and to cook in the classroom, improving their eating habits and becoming mindful caretakers of their community and the environment.

The DJUSD Food Waste Diversion Project included vermicomposting, composting, food rescue efforts and a switch to an offer vs. serve food service plan. At all schools in Davis, including the three sites for this project, the DJUSD Nutrition Service director implemented a lunch program that offered students a choice of entrees and fruits or vegetables. Providing students with a choice at lunch can reduce the waste stream. Also at all three project sites, the organic waste generated from student lunches and school gardens was composted or vermicomposted. The methods of composting include a mid-scale composting system with an enzyme pretreatment, mid-scale composting and vermicomposting systems without pretreatment and a classroom scale vermicomposting system. Rescue of edible, unopened food was included in the project at Cesar Chavez and Pioneer Elementary Schools. To further reduce the lunch waste stream, molded fiber trays replaced the polystyrene ("foam") trays previously used for hot lunches at Cesar Chavez and Pioneer.

Establishing a team of teachers, parents and students at each school site was the first step in implementing the program. Primary to each team was a salaried site coordinator. All site coordinators worked with the Project Manager and Assistant Project Manager to audit the lunch waste stream at their sites and create work plans based on

that waste stream. The project included audits and a planning phase in order to design systems that were appropriate to the needs and resources of the school and to ensure school-site buy in. Additional factors in the success of the project were training of staff, teachers and students throughout the project, integrating the composting into the curricula, assessment of the results and outreach to the community.

Site Descriptions

Each of the three school sites was able to successfully divert food waste and implement effective composting systems for handling that waste. Two of the three schools, Cesar Chavez and Pioneer, significantly reduced the total school waste stream and thus the costs of disposal by decreasing the lunch waste stream. Each pilot sites also demonstrated different strengths in one or more additional components of the project such as integrating it into the curriculum or bringing the project to the community. Brief descriptions of the lunch waste diversion at each school along with its particular strengths in other areas follow.

Birch Lane Elementary

Food waste only was collected on a daily basis and fed to worms in four, classroom sized, continuous flow through systems. The Birch Lane school waste stream, prior to the implementation of the program, totaled 4 cubic yards picked up 5 times a week, for a total of 20 cubic yards per week. Although the school waste stream has not been significantly reduced this year, with a limited additional effort that includes creating a sorting station, separating the lunch trays out of the waste stream and collecting 100% of the compostable food waste, there is the potential to reduce the waste stream by a minimum of approximately 20% and thus save the DJUSD a minimum of \$1975 next year in disposal fees alone.

The composting project at Birch Lane has been most successfully integrated into the classroom, due to the efforts of the two school science teachers, one of whom is the site coordinator for the Lunch Waste Diversion Project. The science teachers produced a garden/worm folder for all primary grades filled with the current science guidelines and lesson plans, presented the lessons to staff, and implemented vermicomposting activities in all intermediate science prep classes. The lessons in the classroom were strengthened by participation in the care of the worms. Eight “science teams” were created from each intermediate grade level class and assigned, on a rotating basis, the daily duties of collecting, weighing and recording the compostable food waste.

Two important lessons were learned from Birch Lane. The first is that the most significant reductions in the waste stream result from removing the foam trays from the lunch system. Substituting a “carry-out” tray¹, which costs less than the foam tray and can be recycled is critical to reducing the lunch waste stream and saving on disposal costs. Employing a site coordinator who is able to monitor the waste stream and devote lunch time hours to the project is also very important. Employing a teacher as the site coordinator offers the benefit of more readily integrating the waste diversion project into the curriculum. Doing so is critical to its success: it must be much more than a waste management project. Employing a teacher as the site coordinator however creates additional

¹“Carry out” trays are a lightweight cardboard and are recyclable in Davis, even when contaminated with some food waste. The district purchased the Child Nutrition Tray from Sysco. The cost for 500 per case (Dapaco 7667) is \$13.10 per case. They are available plain (without the child nutrition writing on them) and may cost a little less.

responsibility for the teacher. Much of that responsibility must be met during the lunch hour, a time when teachers need a break. As site coordinators teachers must thus enlist the support of the parents, students and other teachers to optimize diversion rates.

Cesar Chavez Elementary

Students sorted all lunch waste each day after they ate, which was then recycled, rescued or fed to the worms by the site coordinator at Cesar Chavez. A sorting station was built that includes a platform dolly with labeled containers for food rescue, worm food, trays, and recyclable materials. Recyclable trays have replaced the foam trays, which were previously thrown away and contributed significantly to the lunch waste stream. Edible, non-opened food is set aside for sharing, returning to the food service or donating to the homeless. Cans, paper bags, cardboard boxes and plastic containers are separated and put in the on-site recycling bins. Compostable food waste is fed to the worms, which are housed in a continuous flow stacking system that was constructed by the site coordinator and project managers. Worms donated to the project quickly reached populations capable of digesting all of the worm food (approximately 13 pounds) generated each day.

As a result of this project, the waste stream at Cesar Chavez has been reduced from 6 cu yards picked up every day (total 30 cubic yards per week) to 4 yards picked up 4 times a week (16 cubic yards) for a 47% reduction. The reductions were phased in, saving the Davis Joint Unified School District approximately \$2800 in disposal fees alone. Reductions in labor for the custodian and materials such as trash bags are not included. The project has the potential to save the district \$6765 in waste disposal fees each year it is continued. The cost to continue the system will be \$3850 per year, for a net savings to the district of \$2915.

The significant reductions in the waste stream from Cesar Chavez and the fact they were accomplished with very little capital investment are the strengths of this site. The cost of equipment for both sorting the lunch waste and vermicomposting the food waste was \$775, one-half and one-third the cost of materials at the other two sites. Cesar Chavez was able to demonstrate that lunch waste can be significantly reduced on a very low budget.

Another critical lesson learned from Cesar Chavez was the value of creating a site team. The site coordinator was very dedicated to waste reduction, but expecting one person to meet all the program goals is unrealistic. We were very fortunate to have help, on a daily basis, from the custodial staff. A site team of teachers, students, staff and other parents will be important to continuing at Cesar Chavez. Integrating the project into the garden will also help, particularly in integrating the composting activities into the curricula through the garden program.

Pioneer Elementary

Lunch waste at Pioneer Elementary was diverted beginning the first day of school at which time the offer vs. serve hot lunch was also implemented. Recyclable materials were separated and trays were sorted for recycling or composting. Edible food was rescued and donated to the on-site childcare facility and the school nurse. Non-edible, compostable food waste was either combined with yard and garden waste and composted or fed to the worms. As a result of the project, the total waste stream at Pioneer Elementary has been reduced from 4 cubic yards

picked up 5 times a week (20 cubic yards per week) to 4 cu yards picked up 2.5 times a week (10 cu. yds.) for a 50% reduction. We estimate the project has reduced disposal fees for the Davis Joint Unified School District by approximately \$3430 for the 2000-01 school year, with the potential to save the district \$5000 in fees each year the project is continued.

Pioneer has a very popular and successful school garden into which the Lunch Waste Diversion Project was easily integrated. Significantly, a salad bar, called the “Crunch Lunch” was also implemented at Pioneer Elementary in March. Students were given the choice between the hot lunch and a salad bar, which offers fresh, locally grown fruits, vegetables and proteins and carbohydrates. It has been a tremendous success and an average of 179, with as many as 300 students choosing the Crunch Lunch. Demand for hot lunches, which averaged 235 per day the previous school year, decreased to 114 per day.

The lunch waste stream changed after introduction of the salad bar but the details were somewhat unexpected. On a per weight basis, the lunch waste remained the same, but the weights and volumes of the types of lunch waste changed. Edible food waste decreased by more than 60%; students throw away less edible food when offered the choice of a salad for lunch. On the other hand compostable food waste increased by almost 90% on a per weight basis. This increase was anticipated and the system at Pioneer was capable of composting the increased amounts.

The Grand Opening for the Pioneer Salad Bar was held April 12th. The salad bar gained a significant amount of media attention with articles in the local papers, TV and radio and a national magazine. All media coverage included the lunch waste diversion component of the project as critical to closing the loop and thus modeling environmental stewardship with school lunch and garden programs.

In addition, the integrated garden, salad bar and composting program at Pioneer was presented to the Davis Joint Unified School Board at their meeting on April 5, 2001. Pioneer also offered two composting workshops to Davis residents, thus most successfully educating the community on food waste composting.

Audits

On average, each school generated 141 pounds of lunch waste per school per day. Food waste totaled almost 105 pounds per day. On an annual basis the food waste adds up to 9.2 tons per school or slightly more than 25 pounds per student. Thus approximately 75% of the lunch waste stream, on a per weight basis, is food.

The largest component of the lunch waste stream, again by weight, is the food that can't be rescued and can't be composted. Almost forty percent of the lunch waste is non-compostable, non-edible food waste, which could be fed to livestock but is currently landfilled. Edible food that is thrown away each day is also a large portion of the lunch waste. On a daily basis, students throw away almost 34 pounds of edible food at each school. This is equivalent to 24 % of the lunch waste by weight. It is also equivalent to 3 tons of edible food thrown away by each school, each year— enough to fill 3 dumpsters at each site. Worm food or compostable food waste generated each day averaged almost 15 pound per day per school, approximately 11% of the weight of the total daily lunch waste.

Remarkably, the food waste portion of the lunch waste stream was reduced by more than one-third when

the salad bar was implemented at Pioneer Elementary. The edible food fraction of the food waste decreased by more than two-thirds: students throw away less edible hot lunch food when they are presented the alternative choice of a salad. Detailed pre and post salad bar audit results are included in Appendix B.

On a per volume basis, the lunch waste accounts for 23% of the school's annual total waste stream. And the disposal costs are based on the volume of material generated, not the weight. Cost for disposing of the lunch waste prior to implementing a diversion program averaged \$2670 per school per year. Trays make up the largest portion of the lunch waste stream on a per volume basis. On average, more than 18 cubic feet of trays were thrown away at each school every day. This is equivalent to one-third of a dumpster per day of trays alone and costs the DJUSD approximately \$1333 per year. It is estimated that each tray, which initially costs approximately 3 cents, costs the district slightly more than that to throw away.

Integration into the Curriculum

Integrating lunch waste diversion and composting into the curricula is critical to creating a program that is an educational opportunity and not just a waste management program. Towards that end, a collection of resource materials, including *Worms Eat My Garbage*, 2 copies of *Worms Eat Our Garbage*, *Worm Café*, *Let it Rot* and a copy of the video *Worm Bin Creatures Under the Microscope* were purchased for teachers at each school. Additional efforts to assimilate the project into the curricula have varied from site to site as described above. The Farm to School Program, with the assistance of the UC Davis School Gardens Project, will continue to work on integrating the lunch waste diversion into the school garden projects and the school curriculum. In addition, the site coordinator at Pioneer will be devoting time during the summer to identifying garden based and waste management based activities that can be used by teachers to meet state standards in multiple subjects.

Outreach to the Community

In addition to reaching parents and residents through the media, school fliers, open houses and presentations to the school board (described above), the project manager has been assisting a number of additional schools in Davis who are interested in implementing vermicomposting projects next year. The worm bin at Cesar Chavez has been demonstrated to an Emerson Jr. High teacher. A description of how to start a vermicomposting system at a school has been completed and sent to parent volunteers at Patwin Elementary and Valley Oak Elementary and is available to any school that requests it.

Publication of a project quarterly report by the CIWMB has also led to opportunities to share project information with school districts in Los Angeles and Bakersfield. It is anticipated that this final report will be made available to school districts requesting more information. A description of the project will be included in the revised edition of *Worms, Worms and More Worms*. Another more comprehensive article for publication in the local paper is also planned.

Lessons & Recommendations

As is true for any pilot project, many lessons were revealed. Some of the lessons and the recommendations that follow from them are described briefly below.

1. It cannot be assumed that the school district will recognize the value of modeling integrated waste management and giving students the opportunity to practice solutions to the environmental problems that they are learning about in their classes, even when such solutions decrease waste hauling costs. It is therefore very important that any waste diversion project early on identify and the develop support from the School Board and District Superintendent.
2. The site coordinator is more than an addition to the custodial staff as that person's responsibilities include creating a site team, evaluating and reducing the waste stream and facilitating the integration of the program into the curriculum. Paying that person for the 1.5 hours per day required to fulfill those responsibilities is critical.
3. Implementing, managing and integrating a lunch waste diversion project into the school curricula is a lot of work. A team including the site coordinator, teachers, staff and parents is needed. Students are valuable members of the team which then makes the project an excellent educational opportunity. The high school service-learning program could also be a valuable partner to a lunch waste diversion project, providing high school students to site teams while offering them an opportunity to meet service-learning requirements.
4. Signing a memo of understanding between the principals, site coordinators and district staff would clarify everyone's roles and commitments. One site coordinator was not always sure of the principal's support for the project at that school.
5. Audits are critical to designing appropriate composting or vermicomposting systems, keeping the project within budget and preventing problems.
6. Disposable trays make up the largest portion of the lunch waste stream. They can cost as much to throw away as it does to purchase them. Substituting recyclable or compostable trays is thus very important to reducing the waste disposal costs.
7. Edible food is also a significant portion of the lunch waste, on a per weight basis. Food sharing policies and options for returning unopened food to the district's food services or donating it to off site sources must be defined. Information on the Good Samaritan Act would facilitate this process.
8. There are often others who are using the school's waste containers. Identifying who has access to the dumpster and either encouraging their participation or preventing their access to the containers is important.
9. Salad bars do not generate additional lunch waste, though they do change the nature of the waste stream. More compostable food is generated but significantly less edible food is thrown away.

The Future of Lunch Waste Diversion in the Davis Joint Unified School District

We estimate that gross savings of \$6230 in disposal fees alone have been generated for the district for this year from reductions in the waste stream at Cesar Chavez and Pioneer Elementary Schools. This does not include the reductions in the custodial staff and materials, nor does it include the costs of the program, which were covered by contract with the California Integrated Waste Management Board. Nor does it take into account the value of the educational opportunities the program provides students. Additionally, the savings would have been greater had the compostable or recyclable trays been used for serving lunch starting at the beginning of the school.

With minimal additional effort, the waste stream at Birch Lane could be reduced by 20%. Combined with 47 and 50% reductions at Cesar Chavez and Pioneer this will generate a gross savings of \$13,675 in the disposal fees only, or approximately a 37% reduction. If the labor for the custodians to bag and haul lunch waste to the dumpster each day is reduced by 15 minutes at each site, the gross savings are projected to be approximately \$16,250 for all three school sites in the 2001-02 school year. This is equivalent to a gross savings of approximately \$7.85 per enrolled student. Multiplied across the school district this savings would be substantial.

The project finished at a total cost of \$30,822, lower than the \$35,052 contracted with the CIWMB. It is estimated that the cost to continue at each school site will be \$3850 for continued payment of the site coordinator and minimal repairs to the equipment. Potential net savings per school site are thus projected to be approximately \$1565 per school or \$4695 per year for all three schools. Had the program been initiated without the financial support of CIWMB the payback period for the district would be approximately 5 years. However, The DJUSD Food Waste Diversion Project was implemented this year under a contract with the California Integrated Waste Management Board and all costs were covered by that contract.

A total of 8 additional elementary and junior high schools in Davis have indicated interest in starting composting or vermicomposting lunch waste next year. To support start up of new school sites, commitments for the purchase of sorting stations for each school (\$300 value each) and copy costs for parent outreach (\$300 per school) have been made by Davis Waste Removal and the City of Davis.

Growth of the DJUSD lunch waste diversion project by adding 8 school sites next year would be too great and is not recommended. However were the DJUSD to continue the program at Birch Lane, Cesar Chavez and Pioneer plus initiate programs at 3 additional schools, as proposed to the DJUSD Deputy Superintendent for Business Services, the program would be manageable and financially self-sufficient. Under the guidance of a part time manager (\$5,000 salary), total costs for diverting lunch waste at 6 schools are projected to be \$30,300, which includes a 5% district overhead. If each school reduces their waste stream by 40%, as has been demonstrated this year, the total savings (\$32,490) would more than cover the cost of the program and the payback period would be less than one year.

The DJUSD originally agreed to channel the savings generated by this project back into the lunch waste diversion project, in order to continue funding the site coordinators and maintaining the composting or vermicomposting systems. The DJUSD Deputy Superintendent of Business Services has however, now determined

that they should not proceed with the project at any level and that his office is are not willing to financially support any lunch waste diversion efforts. The results of the pilot year are considered insufficient evidence of it cost effectiveness. Should the state mandate schools reduce their waste, as is now proposed in SB 373, the DJUSD will wait to see how the State Board of Education and the CIWMB implement the legislation and then work to integrate the program into the district's waste management and education programs.

There is sufficient interest and dedication on the part of parents, teachers and staff to continue diverting food from the lunch waste stream at the current and new sites without funding from the school district. Such a program will focus, in the short term on composting or vermicomposting food waste and the associated educational opportunities for students, modeling environmental sound practices for our students and integrating the composting program into our school garden program, as part of a larger Farm to School vision. Reducing the lunch waste volume and thus decreasing the disposal costs for the district will not be included in the goals as doing so would be more responsibility than can be met on a volunteer basis. The Davis Farm to School Connection will continue to encourage district and School Board support for diverting lunch waste on a larger scale and will look for additional funding sources.

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Introduction

The Davis Joint Unified School District (DJUSD) is located in Yolo County, an agricultural county in Northern California, near Sacramento. It has an average daily attendance of 8,270 kindergarten through twelfth grade students in its 15 schools. The district consists of 8 elementary schools, 2 junior high schools, one high school, one continuation school, and one alternative school. It is a rapidly growing district: a bond measure was approved by the community to construct two new elementary schools, one junior high school and several modernization projects.

The DJUSD is uniquely poised to model how a medium-sized school district conceptualizes and implements a lunch food waste diversion program in a suburban county. The food waste diversion project was created by the Davis Farm to School Connection, a coalition of district staff, parents and community members with a vision to educate and nourish students through a farm and garden-based experience. The coalition, a project of the Davis Educational Foundation, has raised funds to link school gardens to the opportunities for students to eat from locally supplied salad bars, to visit local farms and to cook in the classroom, improving their eating habits and becoming mindful caretakers of their community and the environment.

The DJUSD has a garden in every school, in keeping with Superintendent of Public Instruction Delaine Eastin's goal. These gardens are being increasingly incorporated into the curriculum through the efforts of a district-wide garden coordinator and the support of the School Gardens Project at the University of California, Davis. In addition, The City of Davis has been a leader in solid waste reduction and has provided significant support to school recycling programs.

The three school sites selected for this project were Birch Lane, Cesar Chavez and Pioneer Elementary. Each has very successful garden programs and a history of small scale composting efforts. At Birch Lane Elementary, five teachers installed worm bins in their classrooms the previous school year. In each class, the students fed the worms and separated the castings. At Cesar Chavez Elementary, green waste from school gardens has been composted for the past seven years. During a school-wide lunchtime recycling program in the spring of 2000, students composted their organic lunch waste and achieved a 24% reduction in the waste stream, on a per weight basis. And second graders at Pioneer Elementary School have been composting organic lunch waste as a garden curriculum activity for the past five years.

Project Goals

The goal of the Food Waste Diversion Project was to develop and test site-specific systems to reduce the lunch waste stream and in particular to reduce the food waste components of the lunch waste while engaging students in the ongoing practice of composting and recycling. Three different methods of composting food waste and reducing or recycling other materials in the lunch waste stream were implemented at the three sites in order to also gain information about the various composting systems appropriate to school programs. Specific objectives included:

- A. Create a self-sustaining composting program by reducing the waste disposal costs.
- B. Train teachers to use composting as part of grade level curricula.
- C. Provide students with a hands-on learning opportunity.
- D. Model best practices of reduce, reuse, recycle and rot.
- E. Integrate food waste composting into the garden program as part of a larger vision, the Davis Farm to School Program.
- F. Educate parents and community about the program objectives.

Personnel & Contributors

Contract Manager

Aaron Shonk, DJUSD Resource Enhancement Coordinator, took over the responsibilities of contract manager in January 2001 from Jim Newman, DJUSD Director of Maintenance and Operations. Mr. Shonk has been managing the finances for the project and the contracts with all subcontractors (below). He has met with the project manager and site coordinators and has been the liaison between the project and the other district personnel contributing to the project, the DJUSD Superintendent and Deputy Superintendent and the School Board. He will make project results available to other school districts.

Project Manager

Cynthia Havstad, co-coordinator of the UC Davis School Gardens Project, conducted composting training for site coordinators and teachers, consulted on training students, assisted in identifying staff for site teams, coordinated the development of site project workplans, consulted on site and worm bed construction, designed and built the vermicomposting system at Cesar Chavez, selected and purchased reference materials and equipment, conducted periodic visits and meetings with site teams, designed a data collection model to capture before and after food diversion and hauling costs, established target reduction goals and assisted in the analysis of the program's economic benefits, publicized program, wrote preliminary and final reports. Ms Havstad contributed 410 hours.

Assistant Project Manager

Lynn Wheeler, a UC Davis student, assisted in gathering and analyzing audit data, conducting periodic

visits and meetings with site teams, building the vermicomposting and collecting systems for Cesar Chavez, promoting the project and maintaining the composting systems. Ms Wheeler contributed 210 hours.

Site Coordinators

Jamie Buffington, Diana Taylor and Caroline Thomas each established target waste reduction goals for each of the 3 pilot sites, worked to develop site teams and work plans, conducted before and after waste audits, interfaced with existing recycling/garden programs, managed the implementation and daily operations of the site composting systems, assisted with the publicity and data collection. They each contributed between 180 to 240 hours or 1.5 hours per day for 180 days.

Technical Consultant

Tapani Koivunen conducted preliminary audits, assisted in planning the composting process and the pretreatment of organic materials with enzymes, purchased and installed equipment and helped maintain the composting system at Pioneer Elementary. He contributed 95 hours to the project.

Interim Director of DJUSD Student Nutrition Services

As part of her responsibilities to the directorship, Norma Roberts implemented an "offer vs. serve" lunch program, collected data on numbers of students ordering hot lunch and made them available to this project. For the purposes of this contract, she ordered and disseminated the molded fiber lunch trays and cardboard carry out trays.

DJUSD Maintenance and Operations Employees assisted in the maintenance and repairs at schools in the DJUSD. Custodial staff: Luis Ramirez, Enrique Soliz and Lloyd Ash, assisted in the daily operations, primarily by bringing the sorting station to the lunch site.

Advisors

John Geisler is the Operations Manager at Davis Waste Removal, which manages all waste removal in Davis, including recycling and composting of green waste. Mr. Geisler contributed his expertise to the project manager and site coordinators.

Diane Makley has been the City of Davis Recycling Coordinator for ten years. Ms Makley educated students about the use of reusable lunch containers, promoted home composting and assisted the project manager with publicity.

Site Descriptions

Three different methods of composting food waste and reducing other portions of the lunch waste stream were implemented at the three pilot sites in order to understand which composting systems would be most appropriate to school needs and resources. Each of the three school sites was able to successfully divert food waste and implement effective composting systems for handling that waste. Two of the three schools significantly reduced the total school waste stream (by 20 and 35%) and thus the costs of disposal by decreasing the lunch waste stream. Different pilot sites also demonstrated different strengths in one or more additional components of the project: integrating it into the curriculum or bringing the project to the community. Detailed descriptions of the lunch waste diversion at each school along with their particular strengths are as follows:

Birch Lane Elementary

Birch Lane Elementary School began the 2000-01 school year with an enrollment of 649 students. All but the kindergarten students or approximately 549 are scheduled to eat lunch at school each day, during 3 lunch periods. The school has two 2-cubic-yard dumpsters on site, both of which are emptied every day, 218 times per school year (although school is in session for 176 days per year). The disposal volume and costs for the 99-00 school year, before project implementation, were as follows:

Table 1: Birch Lane Disposal Volume and Cost					
Number Dumpsters	Total Dumpster Volume		Service/week	Cost/day	Cost/year
	(cu. yds.)	(cu. feet)			
2	4	108	5	\$45.21	\$9856

Project Implementation

The site coordinator at Birch Lane was Diana Taylor. Ms Taylor is also a science teacher at the school, helped found the school garden program and has had a worm bin in her classroom in the past. Assisting Ms Taylor on the Food Waste Diversion Project at Birch Lane have been Science Teacher Holiday Matchett, Science School Improvement (SI) committee members, and student science teams from the intermediate classes. Many staff members received training in composting and/or vermicomposting from Project Manager Cynthia Havstad at the UC Davis Plant Science Teaching Center and Student Farm.

The School Improvement Science Committee decided their theme for the year was 'Do the Rot Thing'. During the previous school year, the compostable food waste generated at the school was estimated by Ms Taylor to be approximately 30-35 pounds per day. Based on this estimate and the interest of the SISC, four classroom sizes bins were selected for the project. The model chosen was the "Eliminator 600 EM", a continuous flow system that can be moved from class to class¹. One side of the bin can be opened to a plexiglass panel for viewing the worm activity. These bins were purchased and installed outside the science classrooms, near the garden, prior to the beginning of the school year.

The site coordinator, project managers, students, staff and parent volunteered contributed to conduct audits in October 2000, in order to evaluate the lunch waste stream without diversion efforts. The results for Birch Lane are reported below. Details of the audits at all sites are described in following section. In addition, a worksheet for conducting an audit is included in Appendix B.

Table 2: Birch Lane Lunch Waste Audit								
	Total Lunch Waste	Total Food Waste	Edible Food Waste	Compostable Food Waste	Non-edible, Non-compostable Food waste	Recyclables	Trays	Garbage
By Weight (lbs.)	118.0	89.3	24.5	13.0	51.8	1.9	4.7	22.2
By Volume (cu. ft.)	34.4	5.1	2.8	.34	1.9	1.6	15.6	12.1

Ms Taylor oversees the daily process, but the duty of collecting, weighing and recording the compostable food waste at lunchtime is rotated among student groups. Eight “science teams” were created from each intermediate grade level class and assigned the care of the worms on a rotating basis. Each day a team took a bucket, labeled ‘WORM FOOD, fruits and vegetables only please!’, out to the lunch tables. After lunch, one member collected shredded paper from the school office for worm bedding. The rest of the team weighed and recorded the weight of the food to be fed to the worms. After recording the amount of food, it was broken up with a shovel, placed in the designated bin and covered with the paper. The process took about 5 minutes. By the end of the year, each team had had the responsibility of feeding the bins at least twice.

Rainy days were an obstacle at Birch Lane as the students ate in their classrooms, making the collection of food waste difficult. In addition, the site has dealt with recurring fruit flies in the bins, for which the principal had little tolerance. Managing the fruit flies involved extra care in covering all food waste with bedding and temporarily reducing the food waste fed to the worms.

Expenses

The costs of building and maintaining a lunch waste diversion and composting system at Birch Lane Elementary are as follows:

Table 3. Birch Lane Expenses		
Site Coordinator	1.5 hrs/day X 180 days	\$2800
Equipment	(4) Eliminator bins	\$1005
	(12) pounds worms	\$160
	(48) pounds worms	Donated (Value \$640)
	Collecting buckets	Donated (Value \$20)
	Scale	\$110
Educational Resources ²	(3) Books & 1 Video	\$100
Outreach Materials	Copy costs	Donated (Value \$100)

¹ Eliminator Vermicomposting Bins are available from Happy D Ranch. A description is included in Appendix A.

² The video “Worm Bin Creatures”, along with the books “Let it Rot” by Stu Campbell, “Worms Eat My Garbage” and “Worms Eat Our Garbage” by Mary Appelhof and “Worm Café” by Binet Payne were purchased for each school site library.

Results

At the beginning of the year, the DJUSD switched from a “serve” only lunch to an “offer” program at every school in the district, which in itself reduces food waste. Birch Lane also implemented the food waste collection program on the first day of school but has collected only fruits and vegetables to process in the worm bins. A total of approximately 400 pounds was collected and fed to the worms. This total is only a fraction of the amount available for feeding to the worms, as indicated by the audits (13 pounds per day times 176 days per school year equals 2288 pounds of compostable food per year or 65 pounds per week). It is also significantly less than the 80 pounds of food waste the four worm bins are capable of composting each week. In addition, the project did not include a food rescue component because of a no food sharing policy at the school. And hot lunches were served each day on a Styrofoam tray that cannot be recycled. As a result of these factors, Birch Lane did not reduce the waste stream or the cost of disposal at the site.

Two important lessons were learned from Birch Lane. The first is that the most significant reductions in the waste stream result from removing the foam trays from the lunch system. Substituting a “carry-out” tray³, which costs less than the foam tray and can be recycled is critical to reducing the lunch waste stream and saving on disposal costs. Employing a site coordinator who is able to monitor the waste stream and devote lunch time hours to the project is also very important. Employing a teacher as the site coordinator offers the benefit of more readily integrating the waste diversion project into the curriculum. Doing so is critical to its success: it must be much more than a waste management project. Employing a teacher as the site coordinator however is a lot of additional responsibility for a teacher. Much of that responsibility must be met during the lunch hour, a time when teachers need a break. Teachers as site coordinators must thus enlist the support of the parents, students and other teachers to optimize diversion rates.

Integration into the Curriculum

The Food Waste Diversion Project at Birch Lane has been most successfully integrated into the classroom, due to the efforts of the two school science teachers. With materials provided by site coordinator, Holiday Matchett produced a garden/worm folder for all primary grades filled with the current science guidelines and lesson plans and presented the lessons to 37 staff members. Holiday Matchett started the year with lessons on worms in all 9 intermediate science prep classes. She and another teacher and member of the site team have shown the video “Worm Bin Creatures” (shows worm bin inhabitants as seen through a microscope) to 9 classes. The video, along with the books “Let it Rot” by Stu Campbell, “Worms Eat My Garbage” and “Worms Eat Our Garbage” by Mary Appelhof and “Worm Café” by Binet Payne were purchased for the school site library.

³“Carry out” trays are a lightweight cardboard and are recyclable in Davis, even when contaminated with some food waste. The district purchased the Child Nutrition Tray from Sysco. The cost for 500 per case (Dapaco 7667) is \$13.10 per case. They are available plain (without the child nutrition writing on them) and may cost a little less.

Outreach to Parents & the Community

On Back-to-School Night, Holiday Matchett gave a presentation to interested parents, resulting in a parent donation of 48 pounds of worms for the Birch Lane vermicomposting system. A flyer was sent home with each student the first week in April, describing the project again and inviting the students to bring their parents to the worm exploration station at Open House on April 10th. (A copy is included in Appendix C.)

The Future of the Project

With a limited additional effort that includes creating a sorting station, separating the lunch trays and recyclable items out of the waste stream and collecting 100% of the compostable food waste, there is the potential to reduce the waste stream by a minimum of approximately 20% and thus save the DJUSD a minimum of \$1975 next year. It is very likely that the waste stream can in fact be reduced by 33% or more, considering the other two school sites achieved reductions of 47 and 50% this year. A proposal to the DJUSD Deputy Superintendent of Business Services to continue the lunch waste diversion project with a budget of \$3850 to continue to pay a site coordinator and maintain the equipment was not accepted. It is likely however, that the vermicomposting project will be continued as an educational project and not in an effort to reduce the cost of disposal.

Birch Lane Elementary is also considering testing a change to their lunch schedule to allow students to play first and then sit down to eat lunch. According to Principal David Brashear, students at Levi Bemis Elementary School in Rialto, California are throwing away less after reversing their lunch and play periods.⁴ Teachers have also noticed improved attention and energy after lunch period, perhaps because the students are eating more of their lunches.

Cesar Chavez Elementary

Cesar Chavez Elementary School had an enrollment of 623 students at the beginning of the 2000-01 school year. Approximately 543 eat lunch at school each day. The school started the year with three 2-cubic-yard dumpsters on site, all of which were emptied every day, 218 times per school year. The disposal and costs for the school are as follows:

Table 4: Cesar Chavez Disposal Volume and Cost					
Number Dumpsters	Total Dumpster Volume		Service/week	Cost/day	Cost/year
	(cu. yds.)	(cu. feet)			
3	6	164	5	\$66.87	\$14,391

⁴ Sacramento Bee, August 9, 2000, p. G3

Project Implementation

The site coordinator at Cesar Chavez was Caroline Thomas. Ms Thomas is a parent of a student at the school and very dedicated to waste reduction. Although Ms Thomas has worked intermittently with the school garden coordinator and a parent volunteer, a Lunch Waste Diversion team at Cesar Chavez has not yet been formed. Three parents have however, indicated their interest in working on the project in the future.

Implemented at the beginning of the school year by the DJUSD Nutrition Services was the switch to an offer vs. a serve hot lunch program. Cesar Chavez then began collecting and diverting lunch waste in late September. By recycling the lunch bags, boxes, cans, bottles and plastic, by rescuing edible food and by collecting compostable food, Ms Thomas was immediately able to reduce the lunch waste stream at Cesar Chavez significantly.

A sorting station was created and includes a platform dolly with containers labeled for food rescue, worm food, recycling and trays. The station and the garbage cans for the rest of the lunch waste were set near the lunch area each day by the custodian. Ms Thomas or a parent-volunteer reminded students to sort their lunch waste. Edible food was rescued and shared with other students, returned to food service or given to the homeless. Non-edible food was collected for a worm composting system at the home of Site Coordinator Caroline Thomas until an audit could be conducted to determine the needs of the school composting system.

Three audits were conducted in October. The results for the lunch waste stream at Cesar Chavez are as follows.

Table 5: Cesar Chavez Lunch Waste Audit								
	Total Lunch Waste	Total Food Waste	Edible Food Waste	Compostable Food Waste	Non-edible, Non-compostable Food waste	Recyclables	Trays	Garbage
By Weight (lbs.)	138.4	102.0	40.8	12.7	48.6	2.0	12.0	22.4
By Volume (cu. ft.)	33.3	5.8	4.3	.35	1.1	.8	18.2	8.5

Based on the understanding of the waste stream gained by conducting the audits, a modified Nelson worm bin was built for Cesar Chavez. (The bin design is included in the Appendix A.) It is a continuous flow system based on stacking trays, which increases the amount of food waste that can be digested by the worms. The bin was constructed in December and placed on site, near one of the school gardens in early January. The worms were donated by the UC Davis Plant Science Teaching Center and Student Farm and have been digesting approximately 13 pounds of food waste per day since early January.

Another important component to the project implemented at this site was the use of a compostable food tray to replace the Styrofoam trays on which hot lunches were served the previous school year. The substitution of this tray led to an immediate and significant reduction in the waste stream. For a trial period of one month, molded fiber trays⁵ were shredded, soaked in water and used as bedding for the worms. Although this was an important

⁵The trays initially used to substitute for the foam trays in this project were molded fiber, 5-compartment trays from Chinet, at a cost of 9.3 cents per tray.

means of reducing the lunch waste stream, it was very labor intensive. The trays are also very expensive and are not readily digested by the worms. A third tray, a lightweight cardboard “carry-out” tray was then tested (see footnote 3). This tray is less expensive than the original foam tray and can be recycled in Davis.

Expenses

Expenditures for the equipment and other site costs at Cesar Chavez Elementary are as follows:

Table 6. Cesar Chavez Expenses		
Site Coordinator	1.5 hrs/day X 180 days	\$3600
Equipment	(1) Vermicomposting Bin	\$415
	(10) pounds worms	Donated (Value \$135)
	Platform dolly for sorting station	\$310
	Collecting buckets	\$50
Lunch trays	Compostable or Recyclable Trays ⁶	\$1329
Educational Resources ⁷	(3) Books & 1 Video	\$100
Outreach Materials	Copy costs	Donated (Value \$100)

Results

As a result of the project, the waste stream at Cesar Chavez Elementary has been reduced to from 3 dumpsters, emptied 5 times per week to 2 dumpsters that are emptied 4 days each week, for a 47% reduction by the end of the year. The reductions were phased in and will save the Davis Joint Unified School District approximately \$2800 for the 2000-2001 school year. The project has the potential to save the district \$6765 in waste disposal costs each year it is continued. The cost to pay a site coordinator and maintain the system will be \$3850 per year, for a net savings to the district of \$2915.

The significant reductions in the waste stream from Cesar Chavez and the fact they were accomplished with very little capital investment are the strengths of this site. The cost of equipment for both sorting the lunch waste and vermicomposting the food waste was \$775, one-quarter and one-third the cost of materials at the other two sites. Cesar Chavez was able to demonstrate that lunch waste can be significantly reduced on a very low budget.

⁶ The cost is the difference between the foam trays and the chinet trays, approximately 6.3 cents per tray. This difference was split between the Nutrition Services Division and the Lunch Waste Diversion Project. However, the fibermold trays were replaced with the previously mentioned carryout trays, which cost 2.62 cents each, in April.

⁷ The video “Worm Bin Creatures”, along with the books “Let it Rot” by Stu Campbell, “Worms Eat My Garbage” and “Worms Eat Our Garbage” by Mary Appelhof and “Worm Café” by Binet Payne were purchased for each school site library.

Integration into the Curriculum

Each school received copies of a number of supporting resources, including the curriculum “Worms Eat Our Garbage” by Mary Appelhof. A worm bin exploration station was very popular at the school wide Science Fair held on April, giving the students an opportunity to study the worm bin creatures. The project at Cesar Chavez has however lacked a strong connection to the student activities and curriculum. Teachers with interest in doing so have been identified. Cesar Chavez has a very strong garden program through which this may be better accomplished. Training on composting, vermicomposting and linking gardens and solid waste management to the curriculum to meet state standards will be offered in the fall by the UC Davis School Gardens Project.

Outreach to Parents & the Community

The project was announced to the parents early in the school year through an article in the garden newsletter. In addition, a flyer describing the lunch diversion and vermicomposting system, similar to the flyer for Birch Lane (see Appendix C.) was sent home with each student in the fall. In January, a short description of the project appeared in the local newspaper. (Appendix C.)

The Future of the Project

The estimated savings in disposal fees generated for the district by diverting 47% of the waste stream at Cesar Chavez will be \$6765, or significantly more than the cost of continuing the program. However, a proposal to the DJUSD Deputy Superintendent of Business Services to continue the lunch waste diversion project with a budget of \$3850 to continue to pay a site coordinator and maintain the equipment was not accepted. It is likely the vermicomposting will be continued as an educational project, managed on a volunteer basis, without attempting to reduce the cost of disposal.

Pioneer Elementary

Pioneer Elementary School has an enrollment of 795 students. Approximately 675 are scheduled to eat lunch at school each day, during 3 lunch periods. The school has two 2-cubic-yard dumpsters on site, both of which were emptied every day, 218 times per school year. The disposal and costs for the school are as follows:

Table 7: Pioneer Disposal Volume and Cost					
Number Dumpsters	Total Dumpster Volume		Service/week	Cost/day	Cost/year
	(cu. yds.)	(cu. feet)			
2	4	108	5	\$45.21	\$9856

Project Implementation

The site coordinator at Pioneer Elementary is Jamie Buffington. Ms Buffington is a Master Gardener and the Garden Coordinator at Pioneer, and instrumental in the success of that program. The Waste Diversion team at Pioneer includes student council members, teachers and parent volunteers. A Davis High School student was also able to work for the project from October to January to fulfill his service-learning requirement. Site coordinator and team members at Pioneer relied on Ms Buffington's experience as a Master Gardener for their training on composting and vermicomposting.

Pioneer purchased and built their collecting station and composting system before school started in September, in order to be in place the first day of school. The system was designed by a parent of a student at Pioneer and based on an evaluation of the lunch waste stream the previous year. Although the evaluation was not accurate and more equipment was purchased for the school than was needed (as indicated by the audits conducted in October), the system has helped the site meet another important goal of producing large amounts of compost for its school garden.

Expenses

The costs of building and maintaining a lunch waste diversion and composting system at Pioneer Elementary are as follows:

Table 8. Pioneer Expenses		
Site Coordinator	1.5 hrs/day X 180 days	\$3600
Equipment	(1) Chipper/Shredder	\$960
	(4) Compost Tumblers	\$1400
	(1) Vermicompost bin	Donated (Value \$200)
	Platform dolly for sorting station ⁸	\$310
	Collecting buckets	\$50
Lunch trays	Compostable or Recyclable Trays	\$1561
Educational Resources	(3) Books & 1 Video	\$100

Audits were conducted in early November. Pioneer Elementary has the largest number of students of all three pilot sites and therefore generates the largest amount of lunch waste. The analysis of the lunch waste stream at Pioneer is as follows:

⁸

The collection station for Pioneer was purchased with funding from a separate grant.

Table 9: Pioneer Lunch Waste Audit (Pre-Salad Bar)								
Fall 00	Total Lunch Waste	Total Food Waste	Edible Food Waste	Compostable Food Waste	Non-edible, Non-compostable Food waste	Recyclables	Trays	Garbage
By Weight (lbs.)	166.4	122.6	36.5	18.6	67.5	4.8	5.0	34.0
By Volume (cu. ft.)	41.9	5.8	1.2	2.6	2.0	2.0	21.0	13.2

Ms Buffington managed the collecting and sorting lunch waste at Pioneer on a daily basis. She or a parent volunteer brought the sorting station to the lunch area each day and reminded students to separate out the recyclables, the compostable food waste, trays and edible food. Compostable food waste was either combined with yard and garden waste and composted or fed to the worms. Some of the organic materials were treated with an enzyme donated by a parent and others were composted without pretreatment. Rescued food was collected and donated to on site child development center.

As was true at every school in Davis, the hot lunch components were offered rather than served, giving students a choice of entrees and fruits and vegetables and thus reducing waste. Molded fiber trays were also used to serve hot lunches at Pioneer. The students separate and stack the trays, which are later shredded and added to the compost tumblers. Although this was an important means of reducing the lunch waste stream, the trays are very expensive and shredding them was still very labor intensive. A third tray, a lightweight cardboard “carry out” tray (the same as that used at Cesar Chavez) has been introduced. It was also sorted and stacked by the students and then recycled. These carry out trays however, cannot be put through the chipper/shredder as they clog the equipment.

On rainy days, the hot lunch students ate in the multi-purpose room while students who brought their lunches from home ate in the classroom. Thus only hot lunch students sorted their waste after lunch when the weather was bad.

Unique to Pioneer was the introduction of a salad bar in March. The salad bar, or “crunch lunch” was offered as an alternative to the hot lunch every day. Students were given the choice between the hot lunch and a salad bar, which offers fresh, locally grown fruits, vegetables and proteins and carbohydrates. It was tremendously popular and an average of 179, with as many as 300 students, have been choosing the Crunch Lunch. The salad bar component is part of the Davis Farm to School Program, which has a mission to introduce it, along with the gardens and the recycling project to every school in Davis.

Due to the introduction of the salad bar, the audits were repeated at Pioneer in April. Results of the spring audits are as follows:

Table 10: Pioneer Lunch Waste Audit (Post Salad Bar)								
Spring 01	Total Lunch Waste	Total Food Waste	Edible Food Waste	Compostable Food Waste	Non-edible, Non-compostable Food waste	Recyclables	Trays	Garbage
By Weight (lbs.)	166.3	104.3	14.2	35.1	55.0	7.3	21.2	33.7
By Volume (cu. ft.)	23.5	3.6	.36	1.3	1.9	3.7	2.9	13.4

Results

As a result of the project, the waste stream at Pioneer Elementary has been reduced to from 2 dumpsters, emptied 5 times per week to 2 dumpsters being emptied 2 days each week and one of the two dumpsters being emptied a 3rd time each week, for a 50% reduction by the end of the year. The reductions were phased in, saving the DJUSD a total of approximately \$3430.

One of the most exciting results of the entire project is the significant change in the waste stream with the introduction of the salad bar. Although the lunch waste generated on a per weight basis did not change, the total food waste (by weight) decreased by 15% with the introduction of the salad bar. Compostable food waste increased, as expected, because salad waste is easily composted or digested by worms. The system at Pioneer was more than adequate to handle increased amounts of compostable food waste. Most importantly, the edible food being thrown away decreased by an incredible 60%. At the same time, average hot lunches sold at Pioneer saw significant reductions with the introduction of the salad bar. These facts strongly suggest that many students were throwing away significant portions of their hot lunches and that they throw away less food when given the choice of a salad for lunch.

Another result of the project at Pioneer was the production of approximately 4 cubic yards of compost for use in the gardens. This volume was possible because trays and garden waste were shredded and added to the composting system as well as grass clippings from off site. Pre-treatment of the organic materials prior to composting was not demonstrated as necessary. It is not recommended that the enzymes, which were donated at no cost to the program this year, be purchased for a school composting program. Management of the composting system on a daily or semi-daily basis, particularly when additional organic materials are brought on site for creating additional compost, is the critical factor in a school composting system.

Some additional important additional findings from Ms Buffington's work include identifying CDC (the on-site child care center) as another contributor to the waste stream at Pioneer and thus key players in the goal of reducing waste. It was also determined that locks on the dumpsters were necessary to prevent their use by neighbors.

Integration into the Curriculum

The garden is more thoroughly linked to the classroom activities, which has made it possible to more readily connect the lunch waste diversion project to the curriculum. At Pioneer, all 30 classes were introduced to worms in January through an anatomy lesson. All classes also played a worm game show. To aid in the implementation of the project, Pioneer invited Richard Tsai, City of Davis Recycling to present “Pack a Good Lunch” to its 795 students at the beginning of the year.

Outreach to Parents & the Community

A flyer describing the program (called the recycling program at Pioneer) was distributed to parents at Pioneer Elementary at the beginning of the school year. The vermicomposting and composting systems were demonstrated to interested parents and students at Open House in April. In addition, the integrated garden, salad bar and composting program at Pioneer was presented to the Davis Joint Unified School Board at their meeting on April 5, 2001. Pioneer also offered two composting workshops to Davis residents, thus most successfully educating the community on food waste composting.

The Grand Opening for the Pioneer Salad Bar, called the Crunch Lunch, was held April 12th. Attendees included School Board President Marty West, Davis Mayor Ken Wagstaff, Yolo County Supervisor Louis Wolk and Davis Joint Unified School District Supervisor David Murphy, as well District deputy superintendents and staff and the school principal. All were invited tour the garden, eat salad and sort their lunch waste as the students do. The event, including the lunch waste diversion component of the project gained a significant amount of media attention with articles in the April 14th issues of the Davis Enterprise and the Sacramento Bee. (Appendix C) The Farm to School Project was described by Channel 3 news, KGO radio and in the July issue of Gourmet Magazine. Each description included the lunch waste diversion component of the project as critical to closing the loop and thus modeling environmental stewardship with school lunch and garden programs. Samples of the coverage are included in appendix

The Future of the Project

A proposal to the DJUSD Deputy Superintendent of Business Services to continue the lunch waste diversion project with a budget of \$3850 to continue to pay a site coordinator and maintain the equipment was not accepted although the estimated savings to the district will be \$4928, more than covering the cost of the program.

Site coordinator Ms Buffington has indicated that she will continue the project at Pioneer Elementary even without funding for her position as site coordinator. She will enlist additional parent, teacher and student support. As a volunteer program, the project will not dedicate itself to reducing the disposal costs for the district, but will focus on the educational opportunities of waste reduction. Towards that end, Ms Buffington is aligning the garden and waste based activities to the state standards to more thoroughly integrate them into the curriculum.

Lunch Waste Audits

Audits were conducted at all three school sites in the fall and then repeated in the spring at Pioneer Elementary, after the introduction of a salad bar as part of the lunch program. Cynthia Havstad, Project Manager, defined the audit protocol. Assistant project manager Lynn Wheeler has revised the audit methodology to a more user-friendly format, which is included in Appendix B.

The results of the audits of the lunch waste before diversion are presented in the table below. Detailed results are also included in Appendix B.

Table 11. Average Lunch Waste Audit Results				
	By Weight	By Volume		Cost
	(lbs/day)	(cu.ft/day)	% of total annual waste stream	
Total Lunch Waste	140.9	36.5	23.4	\$2670
Food Waste	104.6	5.5	3.5	\$404
Edible Food Waste	33.9	2.8	1.8	\$200
Compostable Food Waste	14.8	1.1	.7	\$80
Non-compostable, non-edible food waste	55.9	1.7	1.1	\$124
Recyclables	2.9	1.5	1.0	\$109
Trays	4.8	18.3	12.8	\$1333
All other Lunch Waste	26.2	11.3	7.2	\$824

On average, each school generated 141 pounds of lunch waste per school per day. Food waste totaled almost 105 pounds per day. On an annual basis the food waste adds up to 9.2 tons per school or slightly more than 25 pounds per student. Thus approximately 75% of the lunch waste stream, on a per weight basis, is food.

The largest component of the lunch waste stream, again by weight, is the food that can't be rescued and can't be composted. Almost forty percent of the lunch waste is non-compostable, non-edible food waste, which could be fed to livestock but is currently landfilled. Edible food that is thrown away each day is also a large portion of the lunch waste. On a daily basis students throw away almost 34 pounds of edible food at each school. This is equivalent to 24 % of the lunch waste by weight. It is also equivalent to 3 tons of edible food thrown away by each school, each year— enough to fill 3 dumpsters at each site. Worm food or compostable food waste generated each day averaged almost 15 pound per day per school, approximately 11% of the weight of the total daily lunch waste.

Remarkably, the food waste portion of the lunch waste stream was reduced by more than one-third when the salad bar was implemented at Pioneer Elementary. The edible food fraction of the food waste decreased by more than two-thirds: students throw away less edible hot lunch food when they are presented the alternative choice of a salad. Detailed pre and post salad bar audit results are included in Appendix B.

On a per volume basis, the lunch waste accounts for 23% of the school's annual total waste stream. And the disposal costs are based on the volume of material generated, not the weight. Cost for disposing of the lunch waste prior to implementing a diversion program averaged \$2670 per school per year. Trays make up the largest portion of the lunch waste stream on a per volume basis. On average, more than 18 cubic feet of trays were thrown

away at each school every day. This is equivalent to one-third of a dumpster per day of trays alone and costs the DJUSD approximately \$1333 per year. It is estimated that each tray, which initially costs approximately 3 cents, costs the district slightly more than that to throw away.

Costs

The cost of disposal at the three sites, prior to implementation of the diversion project is detailed in Table 12. On average, the DJUSD has been spending \$11,368 per year (\$16.50 per enrolled student) for disposal fees alone. Audits determined that lunch wastes account for 23% of the total and thus the DJUSD has been spending \$2,670 per year per school (or \$3.88 per enrolled student) on fees to dispose of lunch waste. Across the school district, this totals \$32,088 per year for lunch waste disposal fees.

These figures do not take into account the cost of the custodial service and equipment (trash cans and bags). Estimating that the custodian spends an three quarters of an hour per day handling lunch waste, the cost per site increases by approximately \$2500 per site. Total costs per school for lunch waste handling and disposal fees average approximately \$5225 per school per year or slightly more than \$7.60 per enrolled student per year.

Of the lunch waste, the largest fraction is tray waste. The disposal trays fill 1/3 of a dumpster per day at each school. Almost 60 dumpsters per year are filled at each school site with lunch trays (in this case Styrafoam trays). These cost the district \$1333 per year or \$1.93 per enrolled student in disposal fees (without including the cost of custodial labor to bag them and take them to the dumpster). The fee to dispose of each tray is 3.2 cents each, greater than the cost of their purchase. Assuming an average of 237 lunches are served on these trays at each of the 8 elementary schools in Davis, the total disposal fee for trays alone is \$61/day.

Before Program Implementation	Birch Lane	Cesar Chavez	Pioneer	Total	Average	Per enrolled student
Dumpster Volume	\$9,856	\$14,391	\$9,856	\$34,103	\$11,368	\$16.50
Lunch Waste Disposal Fees	\$2,532	\$2,388	\$3,090	\$8,010	\$2,670	\$3.88
Food Waste	\$373	\$415	\$425	\$1,212	\$404	\$0.59
Edible Food Waste	\$209	\$308	\$85	\$602	\$200	\$0.29
Compostable Food	\$25	\$25	\$190	\$240	\$80	\$0.12
Non-compostable, Non-edible Food	\$139	\$82	\$150	\$371	\$124	\$0.18
Recyclables	\$119	\$60	\$148	\$328	\$110	\$0.16
Styrafoam Trays	\$1,149	\$1,305	\$1,546	\$3,999	\$1,323	\$1.93
All other lunch waste	\$891	\$609	\$971	\$2,471	\$824	\$1.20
Labor ⁹	\$2,508	\$2,508	\$2,508	\$7,524	\$2,508	\$3.64
Trash bags ¹⁰	\$53	\$53	\$53	\$159	\$53	\$.07

⁹ It is estimated that the custodian spends ¾ of one hour per day handling lunch waste.

¹⁰ Average number of bags before implementation of a lunch waste diversion project is 10 per school per day.

The costs for disposal fees after program implementation this year are presented in Table 13. After the diversion projects were phased in at Cesar Chavez and Pioneer Elementary schools, the lunch waste and the cost of its disposal fees was reduced by almost 50% at the two sites. The fees were not reduced at Birch Lane, for an average of 30% at the three pilot sites. Including labor and materials, which also decrease when the lunch waste is reduced, the costs to dispose of lunch decreased by approximately \$7,955 at the Cesar Chavez and Pioneer or \$3.85 per student enrolled at all three school sites.

Table 13. Estimated Davis Joint Unified School District Annual Lunch Waste Disposal Costs 01-02						
After Full Program Implementation	Birch Lane	Cesar Chavez	Pioneer	Total	Average	Per enrolled student
Dumpster Volume	\$9,856	\$11,590	\$6,425	\$27,871	\$9,290	\$13.10
Lunch Waste	\$2,532	\$691	\$1,124	\$8,010	\$2,670	\$3.88
Food Waste	\$373	\$82	\$141	\$1,212	\$404	\$0.59
Edible Food Waste	\$209	\$0	\$0	\$602	\$200	\$0.29
Compostable Food	\$25	\$0	\$0	\$240	\$80	\$0.12
Non-compostable, Non-edible Food	\$139	\$82	\$141	\$371	\$124	\$0.18
Recyclables	\$119	\$0	\$0	\$328	\$110	\$0.16
Trays	\$1,149	\$0	\$0	\$3,999	\$1,323	\$1.93
All other lunch waste	\$891	\$609	\$983	\$2,471	\$824	\$1.20
Labor ¹¹	\$2,508	\$1,672	\$1,672	\$5,852	\$1951	\$2.83
Trash bags	\$53	\$27	\$27	\$107	\$36	\$0.05
Total	\$5093	\$2,390	\$2,823	\$10,306	\$3,434	\$4.99
Gross Savings	0	\$3,663	\$4,293	\$7,956	\$2,652	\$3.85
% Reduction						19%

Projected costs for the next school year, 2001-2002, are detailed in Table 14. With minimal additional effort, the waste stream at Birch Lane could be reduced by 20%. Combined with 47 and 50% reductions at Cesar Chavez and Pioneer will generate a gross savings of \$13,675 in the disposal fees only, or approximately a 37% reduction. If the labor for the custodian to bag and haul lunch waste to the dumpster each day is reduced by 15 minutes, the gross savings are projected to be approximately \$16,250 for all three school sites in the 2001-02 school year. This is equivalent to a savings of approximately \$7.86 per enrolled student. Multiplied across the school district this savings would be substantial.

If the lunch waste diversion project were implemented at all 8 elementary schools in the DJUSD, the gross savings to the district is projected to be \$43,350 per year. Costs of the setting up or continuing the program are not included but are described below. Avoided costs, such as the 4 cubic yards of compost that Pioneer produced and thus did not have to purchase for their garden program are not included as they are saved at the school site level and not the district level.

¹¹ Custodial staff time for bagging waste and hauling it to the dumpsters decreased significantly when the numbers of bags of garbage generated dropped from an average of 10 to 5 bags per day. Labor is decreased from ¾ of an hour to ½ hour only.

Table 14. Projected Davis Joint Unified School District Annual Lunch Waste Disposal Costs 01-02						
After Full Program Implementation	Birch Lane	Cesar Chavez	Pioneer	Total	Average	Per enrolled student
Dumpster Volume	\$7,885	\$7,627	\$4,928	\$20,440	\$6,813	\$9.89
Lunch Waste	\$1,239	\$691	\$1,125	\$3,054	\$1,018	\$1.48
Food Waste	\$348	\$82	\$141	\$571	\$190	\$0.28
Edible Food Waste	\$209	\$0	\$0	\$209	\$70	\$0.10
Compostable Food	\$0	\$0	\$0	\$240	\$80	\$0.12
Non-compostable, Non-edible Food	\$139	\$82	\$141	\$362	\$121	\$0.18
Recyclables	\$0	\$0	\$0	\$0	\$0	\$0.0
Trays	\$0	\$0	\$0	\$0	\$0	\$0
All other lunch waste	\$891	\$608	\$984	\$2,483	\$827	\$1.20
Labor ¹²	\$1,672	\$1,672	\$1,672	\$5,016	\$1,672	\$2.43
Trash bags	\$27	\$27	\$27	\$81	\$27	\$0.05
Total	\$2,398	\$2,390	\$2,823	\$8152	\$2,717	\$3.94
Gross Savings	\$2,833	\$7,626	\$5,790	\$16,249	\$5,416	\$7.86
% Reduction						39%

Program Start Up Costs & Payback Periods

The DJUSD Food Waste Diversion Project was implemented this year under a contract with the California Integrated Waste Management Board and all start up costs were covered by that contract. Expenses are detailed in Table 15.

The project finished at a lower cost than the \$35,052 contracted with the CIWMB. It is estimated that the cost to continue at each school site will be \$3850 for continued payment of the site coordinator and minimal repairs to the equipment. Potential net savings per school site are thus projected to be approximately \$1565 per school or \$4695 per year for all three schools. Had the program been initiated without the financial support of CIWMB the payback period for the district would be approximately 5 years.

On the other hand, were the DJUSD to continue the program at Birch Lane, Cesar Chavez and Pioneer plus initiate programs at 3 additional elementary schools, under the guidance of a part time manager (\$5,000 salary), the payback period would be significantly shortened. Total costs for doing so are estimated at \$30,300, which includes a 5% district overhead. If each school reduces their waste stream by 40% the total savings would be more than the cost of the program (\$32,490) and the payback period would be less than one year.

¹² Custodial staff time for bagging waste and hauling it to the dumpsters decreased significantly when the numbers of bags of garbage generated dropped from an average of 10 to 5 bags per day. Labor is decreased here by 25% only.

Table 15. First Year Expenses		
Project managers	Manager (410 hours) Assistant (210 hours)	\$13,457
Site Coordinator	1.5 hrs/day X 180 days	\$10,000
Equipment	Composting and Sorting Stations	\$4830
Worms		\$935
Lunch trays	Compostable or Recyclable Trays	\$2890
Educational Resources	(3) Books & 1 Video	\$300
Outreach	Copy Costs	\$300
Total		\$30,822

Outreach to the Community

The efforts of each site to inform the community about the DJUSD Food Waste Diversion Project and composting in general were included in the site descriptions above. In addition to reaching parents and residents through the media, school fliers, open houses and presentations to the school board (see Appendix C), the project manager has been assisting a number of additional schools in Davis who are interested in implementing vermicomposting projects next year. The worm bin at Cesar Chavez has been demonstrated to a teacher at Emerson Jr. High. A two page description of how to start a vermicomposting system at a school has been completed and sent to parent volunteers at Patwin Elementary and Valley Oak Elementary and is available to any school that requests it. (See Appendix D.)

Publication of a project quarterly report by the CIWMB has also led to opportunities to share project information with school districts in Los Angeles and Bakersfield. It is anticipated that this final report will be made available to school districts requesting more information. A description of the project will be included in the revised edition of Worms, Worms and More Worms. Another more comprehensive article for publication in the local paper is also planned.

Lessons & Recommendations

As is true for any pilot project, many lessons were revealed. These lessons led to the creation of a short description on how to start a school wide vermicomposting or composting project for diverting lunch waste. It is included in Appendix D. The project manager is also available at cmhavstad@ucdavis.edu, for clarification or additional information. Some of the lessons and the recommendations that follow from them are described briefly below.

1. It cannot be assumed that the school district will recognize the value of modeling integrated waste management and giving students the opportunity to practice solutions to the environmental problems that they are learning about in their classes, even when such solutions decrease waste hauling costs. It is therefore very important that any waste diversion project early on identify and the develop support from the School Board and District Superintendent.
2. The site coordinator is more than an addition to the custodial staff as that person's responsibilities include creating a site team, evaluating and reducing the waste stream and facilitating the integration of the program into the curriculum. Paying that person for the 1.5 hours per day required to fulfill those responsibilities is critical.
3. Implementing, managing and integrating a lunch waste diversion project into the school curricula is a lot of work. A team including the site coordinator, teachers, staff and parents is needed. Students are valuable members of the team which then makes the project an excellent educational opportunity. The high school service-learning program could also be a valuable partner to a lunch waste diversion project, providing high school students to site teams while offering them an opportunity to meet service learning requirements.
4. Signing a memo of understanding between the principals, site coordinators and district staff would clarify everyone's roles and commitments. One site coordinator was not always sure of the principal's support for the project at that school.
5. Audits are critical to designing appropriate composting or vermicomposting systems, keeping the project within budget and preventing problems.
6. Disposable trays make up the largest portion of the lunch waste stream. They can cost as much to throw away as it does to purchase them. Substituting recyclable or compostable trays is thus very important to reducing the waste disposal costs.
7. Edible food is also a significant portion of the lunch waste, on a per weight basis. Food sharing policies and options for returning unopened food to the district's food services or donating it to off site sources must be defined. Information on the Good Samaritan Act would facilitate this process.
8. There are often others who are using the school's waste containers. Identifying who has access to the dumpster and either encouraging their participation or preventing their access to the containers is important.
9. Salad bars do not generate additional lunch waste, though they do change the nature of the waste stream. More compostable food is generated but significantly less edible food is thrown away.

The Future of Lunch Waste Diversion in the Davis Joint Unified School District

We estimate that gross savings of \$6230 in disposal fees alone have been generated for the district for this year from reductions in the waste stream at Cesar Chavez and Pioneer Elementary Schools. This does not include the reductions in the custodial staff and materials, nor does it include the costs of the program, which were covered by contract with the California Integrated Waste Management Board. Nor does it take into account the value of the educational opportunities the program provides students. Additionally, the savings would have been greater had the compostable or recyclable trays been used for serving lunch starting at the beginning of the school.

With minimal additional effort, the waste stream at Birch Lane could be reduced by 20%. Combined with 47 and 50% reductions at Cesar Chavez and Pioneer this will generate a gross savings of \$13,675 in the disposal fees only, or approximately a 37% reduction. If the labor for the custodians to bag and haul lunch waste to the dumpster each day is reduced by 15 minutes at each site, the gross savings are projected to be approximately \$16,250 for all three school sites in the 2001-02 school year. This is equivalent to a gross savings of approximately \$7.85 per enrolled student. Multiplied across the school district this savings would be substantial.

The project finished at a total cost of \$30,822, lower than the \$35,052 contracted with the CIWMB. It is estimated that the cost to continue at each school site will be \$3850 for continued payment of the site coordinator and minimal repairs to the equipment. Potential net savings per school site are thus projected to be approximately \$1565 per school or \$4695 per year for all three schools. Had the program been initiated without the financial support of CIWMB the payback period for the district would be approximately 5 years. However, The DJUSD Food Waste Diversion Project was implemented this year under a contract with the California Integrated Waste Management Board and all costs were covered by that contract.

A total of 8 additional elementary and junior high schools in Davis have indicated interest in starting composting or vermicomposting lunch waste next year. To support start up of new school sites, commitments for the purchase of sorting stations for each school (\$300 value each) and copy costs for parent outreach (\$300 per school) have been made by Davis Waste Removal and the City of Davis.

Growth of the DJUSD lunch waste diversion project by adding 8 school sites next year would be too great and is not recommended. However were the DJUSD to continue the program at Birch Lane, Cesar Chavez and Pioneer plus initiate programs at 3 additional schools, as proposed to the DJUSD Deputy Superintendent for Business Services, the program would be manageable and financially self-sufficient. Under the guidance of a part time manager (\$5,000 salary), total costs for diverting lunch waste at 6 schools are projected to be \$30,300, which includes a 5% district overhead. If each school reduces their waste stream by 40%, as has been demonstrated this year, the total savings (\$32,490) would more than cover the cost of the program and the payback period would be less than one year.